DOCUMENT RESUME

ED 282 978 CE 047 213

AUTHOR Long, Gilbert A.
TITLE Problem Solving.
PUB DATE [83]
NOTE 10p.
PUB TYPE Viewpoints (120)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Agricultural Education; Brainstorming; Conflict Resolution; Decision Making; *Decision Making Skills; Postsecondary Education; *Problem Solving; Productive Thinking; Secondary Education; *Transfer of Training; *Vocational Education

ABSTRACT

Teachers of vocational agriculture students should focus on developing problem-solving and decision-making capacities, rather than on rote learning. Such preparation would include instruction in transferring lessons learned to today's and tomorrow's problems. Several factors are involved in facilitating transfer: experiential learning, adequacy of original learning, association of two learnings, and identification of essential elements of past and present situations. The four elements that promote transfer need to be recognized by teachers and deliberately cued in their students to increase the probability of transfer. To help students achieve skill in identifying critical and unvarying elements, teachers need to include in their teaching categorization, identification of critical attributes, predifferentiation skills, and generalizations. Teachers also need to foster creative thinking. Processes that enhance creative thinking can be facilitated by deferring judgment while solutions are offered, setting deadlines and quotas for the production of ideas, and establishing certain times and places for deliberate idea production. Finally, students must learn to solve problems in groups. They need to be taught that learning groups go through identifiable stages that require the leader to accept differing opinions and ideas and negotiate those differences. Transfer, creative thinking, problem solving, and productive membership in cooperative learning groups are important concerns for those who are preparing tomorrow's workers. (KC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED282978

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.
Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
G Long
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

PROBLEM SOLVING

Gilbert A. Long

Farm workers have traditionally been expected to make managerial decisions demanding judgment as part of their job. Ideally, then, those who prepare students for work in agriculture should focus on developing problem-solving and decision-making capacities. Such preparation would include instruction in transferring lessons learned in the past to today's and tomorrow's problems. Problem solving and the ability to productively participate in cooperative learning groups is important to agricultural employment, whether on or off-farm.

Hunter (1971, p. 2) states: "Transfer is the heart and core of problem solving, creative thinking, and all other higher mental processes." Problem-solving instruction needs to gain the efficiency inherent in transfer learning. Several factors are involved in facilitating transfer.

To the extent that our agriculture students each had an occupational experience program, problems that occurred there and were addressed in vocational agriculture classes provided "similarity of environment, actions, and feelings" relative to both activities. This satisfied one important factor in the transfer process (Hunter, 1971, p. 15). If a second transfer factor, "adequate degree of original learning" was also satisfied, additional probability for transfer was gained.

If the student learned in class how to balance rations with sufficient practice and understanding, then, to the extent that his or her own project represented a "recognizable association of two

CE047213

learnings," transfer was again supported. A fourth factor, "identification of essential and unvarying elements which signal that a past learning has relevance and is applicable to a present situation," is likely to be satisfied in ration-balancing problems by their inherent focus on digestible protein, net energy, and dry matter. Differentiating between ruminant and non-ruminants regarding the proportion of roughage and concentrates to be fed and the quality of protein needed, emphasized distinguishing attributes that enabled the student to balance rations for a variety of ages and species of animals. These examples help illustrate how transfers of learning can occur in vocational agriculture.

The four elements that promote transfer need to be recognized by teachers and deliberately cued in their students to further increase the probability of transfer. Verbalizing the critical element that triggers transfer is desirable because it focuses the student on the critical element instead of an unimportant element. Labeling also increases the probability that the element in question will be recognized in a new situation (Hunter, 1971, p. 92). We need to label the relevant rather than irrelevant dimensions of a learning situation. Appropriate emphasis on the key concepts or unvarying elements of a learning does not allow for the clutter of extraneous detail that characterizes a normative grading system. Testing for the unessential detail, the "history of the breed," and other nonfunctional and irrelevant information supports traditional norm referenced grades but is counterproductive to teaching for transfer. The identification of critical elements, attributes, and generalizations that serve to

identify or characterize is within the control of the teacher to a greater degree than the other three factors.

To achieve skill in identifying critical and unvarying elements, attributes, and generalizations, we need to include in our teaching: (1) categorization, (2) identification of critical attributes, (3) predifferentiation skills, and (4) generalizations.

To quote Hunter (1971, p. 92):

> It is not sufficient for a learner to merely understand the meaning of concepts and generalizations. They must be able to apply this learning outside of the classroom setting. You, as their teacher, should develop strategies so the students acquire and use knowledge to implement the problem-solving and creative process rather than acquiring knowledge as an end product.

Hunter seems to be speaking directly to vocational teachers. It is so much easier to construct a paper and pencil test when a performance test would more appropriately test problem-solving skills. How tempting it is to let the text or reference carry the instructional responsibility rather than to select and emphasize the factors that aid transfer.

Predifferentiation skills training is particularly important when the task to be learned is a complex one or when the learner lacks background experience in the area to be taught. More urban students in vocational agriculture classes necessitates greater use of school farms, animal laboratories, and greenhouses for this very real difference in student background. Predifferentiation skill training means that laboratory experiences be provided rather than textbook focus to substitute for the farm background that our students do not have. Additionally, this generalization reminds us to begin our instruction

where the student is and to increase motivation through breaking complex learning into simpler parts.

Hunter (1971, p. 93) provides a series of generalizations that teachers can use as guides (students should learn to use them also):

1. Always look for knowledge in past experiences that will propel present learning.
2. Identify and label the similarities of the two learnings which make transfer from one appropriate to the other.
3. Use appropriate associations from the past and develop productive present associations.
4. Elicit the appropriate set to perform.
5. Make sure learning is achieved to an appropriate degree.
6. Identify and label the key discriminators that make a situation what it is.
7. Practice transfer. Transfer itself may be made to transfer and is a critical attribute of "learning how to learn."

All teaching should be designed to facilitate transfer. To the extent that we are successful as teachers, broad transfer effects such as confidence in oneself as a learner, and an acquired general approach to learning, should remain after the details of a practiced task are forgotten.

Practicing transfer, such as knowing that a particular percentage slope under specified farming practices risks erosion or that identifiable tillage practices can insure adequate seed-bed preparation for specific soil types and crops, need to be taught and labeled for transfer whenever these situations reoccur. Teaching for transfer will

add meaning to every class and help students progress toward the problem-solving ability required for jobs in agriculture.

Familiarity with and regular use of these transfer elements can do much to provide the tools for problem solving in farming or agribusiness.

Problem-Solving Techniques

Problem solving has long been of concern in vocational agriculture instruction as well as in overall education. A comparison of the literature in both areas is the basis of the following discussion.

Early efforts to teach problem solving in vocational agriculture emphasized use of pencil and paper to process decisions that were often too complex to solve without a systematic approach. Advantages and disadvantages were listed for possible solutions, thus forcing an evaluation of alternatives.

In most cases (too many, in this writer's opinion), such exercises centered on a problem with known answers. Nevertheless, it did emphasize independent thinking and decision-making to select the best answer rather than any need to arrive at a consensus, popular decision. This approach continues to be useful, but problems that do not have discrete answers also need to be addressed. Such problems represent the reality of farming and agriculture.

Creative Thinking

Guilford found that creativity can be learned (Guilford, 1952, pp. 48-61). Studies of creativity since 1948 have emphasized the value of deferring judgment while ideas are being originated. Generation of ideas (problem solutions) is more productive when evaluation of these ideas is withheld until the list is completed (Parnes & Meadow, 1959,

pp. 171-176). While this seems to be a simple and rather innocuous technique, it is, I would suggest, one of the most potent elements of brainstorming. Greater numbers and higher quality of ideas result when judgment is deferred, perhaps because fear of criticism can inhibit creative thinking when each solution is being evaluated before the next alternative is suggested. Certainly the fear of adverse teacher judgment inhibits the less-bold students when potential solutions are critiqued as they are stated. Deferment of judgment until all alternative solutions have been generated is an important problem-solving technique deserving attention from teachers of secondary students, those preparing teachers, and anyone concerned with in-service efforts.

Parnes found it useful to set deadlines and quotas for the production of ideas, and to establish certain times and places for deliberate idea production (Parnes, Education and Creativity, 1963, p. 334). He reported a generally consistent pattern of better ideas being generated in the latter part of the time used to produce ideas (Parnes, Effect of Extended Effort in Creative Problem Solving, 1961, p. 118-121). More and better ideas occured when an effort to produce more ideas is part of the generating procedure.

These findings suggest that traditional problem-solving approaches to teaching in vocational agriculture can be refined to teach students in ways that will release their creative ability. Such efforts can have a lasting affect on students whether they are low or high in initial creative ability and intelligence (Parnes, Education and Creativity, 1963, p. 335).

Group Decision Making

Using transfer techniques to solve problems through conscious use of creative talents is a valuable skill for the individual. Group learning and decision making requires knowledge of group processes. Vocational agriculture has a deservedly good reputation for preparing its students to conduct formal meetings. Our parliamentary procedure team members are excellently prepared. A great majority of the group processes that make up our democratic society are informal, however. Integrative decision making (practiced in informal settings) can add a useful element to our instruction. Four criteria describe the way integrative decision making functions:

1. Avoid arguing for your own individual judgments. Approach the task on the basis of logic.
2. Do not change your mind if it is only to reach agreement and avoid conflict. Support only solutions with which you are at least somewhat able to agree.
3. Shun "conflict-reducing" techniques such as majority vote, averaging or trading in reaching your decision.
4. View differences of opinion as a help rather than a hindrance to decision making.

Our students need to be taught that learning groups go through identifiable stages that require the leader to accept differing opinions and ideas and negotiate those differences. This is a necessary process that leads to better answers. For, although people spend much of their lives talking with one another, few have developed the abilities and attitudes necessary to carry on a worthwhile discussion in which new information, knowledge, skills, and procedures are learned (Johnson &

Johnson, 1982, p. 422). Confrontation must be looked upon as one stage in a learning group's development.

Johnson and Johnson (1982, p. 423) identified seven stages of development of cooperative learning groups as follows:

1. defining and structuring procedures and becoming oriented
2. conforming to procedures and getting acquainted
3. recognizing mutuality and building trust
4. rebelling and differentiating
5. committing to and taking ownership for the goals, procedures and other members
6. functioning maturely and productively
7. terminating

Leadership requires an understanding of decision making and other group processes. Too many students balk at the effort necessary to be a productive member of a learning group. The timid reject the confrontation they encounter on the way to mature functioning. Too often traditional school normative functions focus on memorization and regurgitation to the exclusion of critical thinking and problem solving.

Transfer, creative thinking, problem solving, and productive membership in cooperative learning groups are important concerns for those who are preparing tomorrow's workers. Vocational educators have difficulty forecasting technological change. We are criticized for providing specific job training when employers expect more general literacy skills, ability to learn, and a good work ethic. Our students will be productive in terms of their critical thinking ability and their understanding and skill as members of learning groups.

REFERENCES

Guilford, J. P. Some recent findings on thinking abilities and their implications. Informational Bulletin, 1952, 3, 48-61.

Hunter, M. Teach for Transfer, TIP Publications, El Segundo, California, 1971.

Johnson, D. W., and Johnson, F. P. Joining Together, Prentice-Hall, Englewood Cliffs, New Jersey, 1982.

Parnes, S. J., and Meadow, A. Effects of "brainstorming" instructions on creative problem-solving by trained and untrained subjects. Journal of Educational Psychology, 1959, 50, 171-176.

Parnes, S. J. Education and Creativity, Teachers' College Record, 1963, 64, 4, 331-339.

Parnes, S. J. Effect of Extended Effort in Creative Problem Solving. Journal of Educational Psychology, 1961, 52, 3, 117-122.